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ABSTRACT

Intended for use by all electricity/electronics instructors in the Metropolitan Nashville Public Schools, this guide provides a sequential listing of course content and scope. A course description provides a brief overview of the content of the courses offered in the electricity/electronics program. General course objectives are then listed. Outlines of the course content are presented for these courses: electricity/electronics I and II. Suggested time and specific objectives are provided for each major topic. A listing of resource materials, which includes textbooks, curriculum guides, and audio visual aids, is appended. (YLB)

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ELECTRICITY/ ELECTRONICS

SCOPE AND SEQUENCE

VOCATIONAL EDUCATION

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Metropolitan Public Schools

Nashville Davidson County, Tennessee

Charles O. Frazier, Director

FOREWORD

This scope and sequence guide, developed for the Electricity/Electronics Vocational Education program, represents an initial step in the development of a systemwide articulated curriculum sequence for all vocational programs within the Metropolitan Nashville Public School System. It is a direct result of needs expressed by teachers, parents, and the business community for sequential structure within the vocational education curriculum. An articulated vocational curriculum allows a student to move from one level of instruction to the next without repeating learning tasks already mastered, and without experiencing gaps in the presentation of relevant instructional material.

A goal of this curriculum effort is to provide teachers a usable guide based on input from the teachers. The initial step was an identification of course content, with all teachers having an opportunity to contribute. What follows is a publication using the teachers' contributions: a sequential listing of objectives and skills for each program offering.

This guide does not include all specific resource materials that may be used to assist students in acquiring minimum competencies. It is to serve as a guide for the sequence of course content and scope of what is to be taught. This guide content is extremely important and its use is encouraged. The suggested competencies and resource materials allow instructors an opportunity to be creative and resourceful in meeting the needs of individual programs and students.

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INTRODUCTION

The Electricity/Electronics curriculum has been developed to serve as a guide for instructors in the Metropolitan Public School System. The subject matter has been generally agreed upon by the instructors in this field as being important and necessary in providing a quality program. Topics have been arranged in such a way as to provide for the necessary articulation between programs. It is recognized that additions or modifications may be necessary to accomodate individual differences within each program.

COURSE DESCRIPTION

This course is designed to provide knowledge, skills and understanding necessary for persons entering employment in the electronics field. The study of basic electricity and electronics includes, but is not limited to, soldering techniques, use of small hand tools, AC and DC circuitry, the use of test equipment, preventive maintenance, troubleshooting, repair, installation of electrical and electronic equipment, tuning and alignment of various types of equipment including radio receivers, transmitters, televisions and computer circuits.

The theory of electronics is applied through the design and building of all kinds of electronic circuits which is accomplished by the use of modern tools, instruments, and methods. Skill and knowledge gained in the electronics course are used in the design, construction, installation and maintenance of many types of electronic devices such as communications equipment including radio, television and telephone.

Students have the opportunity to participate in Vocational Industrial Clubs of America (VICA) leadership training and in local, state and national skills competition.

GENERAL COURSE OBJECTIVES

1. To teach safety procedures in the area of electricity/electronics
2. To teach proper care and use of tools and equipment used in eletricity/electronics occupations
3. To develop knowledge, understanding and skills necessary for entry level employment as an electrician or electronic technician or postsecondary training
4. To provide training with the state of the art equipment
5. To provide training by the use of lectures, demonstrations, films, slide presentations, handouts, reading assignments and lab work as applicable

COURSE CONTENT FOR ELECTRICITY/ELETRONICS I

(First Semester)

I. **Orientation (1 week)**

Specific objectives:

To become familiar with school and shop procedures
To become familiar with the materials to be covered

A. Learns school and shop rules

B. Reviews course content

II. **Basic DC theory (7 weeks)**

Specific objectives:

To understand the importance of basic concepts
To develop an understanding of Ohm's Law
To understand series and parallel circuits

A. Understands electron theory

B. Understands energy sources

C. Understands conductors and nonconductors

D. Understands simple schematics

E. Understands Ohm's Law

F. Understands series circuits

G. Understands parallel circuits

H. Understands passive DC circuits

III. **Basic measuring devices (2 weeks)**

Specific objectives:

To learn the major types of measuring devices
To learn how to take measurements using various types of equipment

III. **Basic measuring devices continued:**

A. Measures with ammeter

B. Measures with voltmeter

C. Measures with ohmmeter

D. Measures with multimeter

E. Measures with oscilloscope

IV. **Fundamental skills (2 weeks)**

Specific objectives:

To illustrate the proper techniques used in fundamental skills
To understand the importance of proper technique

A. Learns solder types

B. Practices soldering

C. Practices desoldering

D. Learns wire sizes

E. Practices wire stripping

F. Practices use of hand tools

V. **Fundamental passive components (6 weeks)**

Specific objectives:

To be able to read resistor color codes
To understand various characteristics of resistors and capacitors

A. Understands resistor characteristics

B. Understands resistor color code

C. Understands capacitor characteristics

D. Understands inductor characteristics

E. Understands capacitors or inductors in series

V. **Fundamental passive components continued:**

F. Understands capacitors or inductors in parallel

G. Understands time constants

COURSE CONTENT FOR ELECTRICITY/ELECTRONICS I

(Second Semester)

I. Alternating current theory (6 weeks)

Specific objectives:

To understand characteristics of the AC sine wave
To develop the ability to find various unknowns in LCR circuits

A. Understands sine wave

B. Understands instantaneous, peak and RMS values of voltage

C. Understands instantaneous, peak and RMS values of current

D. Understands inductive and capacitive reactance

E. Understands impedance

F. Understands resonance

G. Understands series circuits

H. Understands parallel circuits

I. Understands power

II. Application of the oscilloscope (1 week)

Specific objectives:

To understand the operation of the basic oscilloscope
To become familiar with some of the more common applications of the oscilloscope

A. Becomes familiar with operational procedure

B. Understands limitations and advantages

C. Understands voltage interpretations

D. Understands waveform interpretations

E. Understands frequency interpretations

III. **Vacuum tubes (1 week)**

Specific objectives:

To understand the basic operation of the vacuum tube
To become familiar with the types and characteristics of tubes

A. Understands theromonic emission

B. Understands diode characteristics

C. Understands triode characteristics

D. Understands tetrode characteristics

E. Understands pentode characteristics

F. Understands gas tubes

G. Understands cathode ray tube

IV. **Semiconductors (6 weeks)**

Specific objectives:

To be able to explain the PN junction
To become familiar with various types of semiconductor devices
To understand operating conditions of diodes and transistors

A. Understands current carriers

B. Understands bias

C. Understands PN junction characteristics

D. Understands semiconductor diode

E. Understands transistor characteristics

F. Understands PNP and NPN - FET and SCR

G. Understands circuit parameter measurements

H. Understands biasing and stabilization

V. **Block diagrams (2 weeks)**

Specific objectives:

Specific objectives continued:

To be able to explain the purpose of block diagrams
To become familiar with block diagrams of popular equipment

A. Explains amplifier block diagrams

B. Explains tape player block diagrams

C. Explains radio block diagrams

D. Explains TV block diagrams

VI. **Residential wiring (2 weeks)**

Specific objectives:

To understand how to wire common circuits found in the home
To recognize household electrical safety

A. Understands fundamentals of various switches

B. Understands wire sizes and ampacity

C. Understands source, load and distribution

D. Understands safety devices, G.F.I.

COURSE CONTENT FOR ELECTRICITY/ELECTRONICS II

(First Semester)

I. **Orientation and review of basic fundamentals (3 weeks)**

Specific objectives:

To review basic concepts and fundamentals
To review basic components and devices

A. Reviews series and parallel resistence

B. Reviews ohm's law

C. Reviews capacitors and X_c

D. Reviews inductors and X_l

E. Reviews impedance

F. Reviews reactive circuits

G. Reviews tubes

H. Reviews semiconductors

II. **Test instruments (2 weeks)**

Specific objectives:

To develop a safe attitude toward work
To become familiar with the proper operation and use of test equipment

A. Understands equipment safety

B. Understands basic test instruments

C. Understands signal tracers

D. Understands the oscilloscope

E. Understands signal generators

F. Understands human sensors

III. **Power supplies (3 weeks)**

Specific objectives:

To become familiar with the operation and design of typical power supplies
To explore common defects found in power supply circuits

A. Understands transformers

B. Understands half-wave rectification

C. Understands full-wave rectification

D. Understands voltage doublers

E. Understands bridge rectification

F. Understands filters

G. Understands regulators

IV. **Amplifiers (4 weeks)**

Specific objectives:

To become familiar with various types of amplifier circuits
To illustrate problems which arise in amplifier circuits

A. Understands safety

B. Understands block diagram

C. Understands transducers

D. Understands controls

E. Understands preamplifiers

F. Understands voltage amplifiers

G. Understands current amplifiers

H. Understands power amplifiers

I. Understands coupled amplifiers

J. Understands frequency characteristics of amplifiers

IV. **Amplifiers continued:**

K. Understands distortion analysis of amplifiers

L. Understands troubleshooting

V. **Oscillators (2 weeks)**

Specific objectives:

To understand various applications of oscillator circuits
To explore the different types of oscillators

A. Understands Armstrong oscillators

B. Understands Hartley oscillators

C. Understands Colpitts oscillators

D. Understands multivibrator oscillators

E. Understands crystal oscillators

VI. **Receivers (4 weeks)**

Specific objectives:

To explore the various circuits found in a typical radio receiver and understand their function
To become proficient in detecting and solving malfunctions found in typical radio receivers

A. Understands wave propagation

B. Understands antennas

C. Understands modulation and demodulation

D. Understands tuned circuits

E. Understands detectors

F. Understands superheterodyne receivers

G. Understands safety

H. Understands block diagrams

VI. **Receivers continued:**

I. Understands controls

J. Understands RD amplifiers

K. Understands mixers

L. Understands IF amplifiers

M. Understands detectors

N. Understands audio amplifiers

O. Understands power supplies

P. Understands troubleshooting

COURSE CONTENT FOR ELECTRICITY/ELECTRONICS II

(Second Semester)

I. Special semiconductor devices (4 weeks)

Specific objectives:

To become familiar with various types of semiconductor devices
To explain techniques used in troubleshooting semiconductors

A. Uses FET's

B. Uses UJT's

C. Uses thyristors

D. Uses varactors

E. Uses LED's

F. Uses phototransistors

G. Uses opto isolators

H. Studies new developments

I. Studies IC's (integrated circuits)

J. Practices packaging of IC's

K. Understands function and types of IC's

L. Understands troubleshooting IC's

II. Logic circuits (3 weeks)

Specific objectives:

To understand the operation of various logic gates
To become familiar with Boolean algebra

A. Understands logic gates

B. Understands truth tables

II. **Logic circuits continued:**

C. Understands Boolean algebra

III. **Monochrome TV receivers (4 weeks)**

Specific objectives:

To understand how various circuits go together to produce a black and white television
To understand the procedures used in troubleshooting a typical black and white television

A. Reviews safety

B. Studies introduction to television theory

C. Understands block diagram

D. Understands controls

E. Understands tuner

F. Understands IF amplifiers

G. Understands video amplifiers

H. Understands audio amplifiers

I. Understands sync and AGC amplifiers

J. Understands vertical and horizontal deflection

K. Reviews power supplies

L. Understands troubleshooting procedure

IV. **Color television receivers (6 weeks)**

Specific objectives:

To understand how additional circuits are added to the black and white television to comprise a color television
To develop procedures used in troubleshooting color TV's

A. Studies safety

B. Studies block diagram

IV. **Color television receivers continued:**

C. Learns controls

D. Learns color circuits

E. Learns convergence procedures

F. Learns picture tube testing

G. Learns troubleshooting

V. **Business procedures (1 week)**

Specific objectives:

To explain a typical business operation
To illustrate various responsibilities involved in the operation of a service oriented business

A. Studies customer relations

B. Studies advertising

C. Estimates repairs

D. Studies financing

E. Studies displays

F. Uses service orders

G. Identifies sets

H. Practices invoicing and billing

RESOURCE MATERIALS

Textbooks

DeGuilmo, Joseph. Electricity and Electronics - Principles and Applications. Albany, New York: Delmar Publishing, 1982.

Matt, Stephen R. Electricity & Basic Electronics. South Holland, Illinois: Goodheart-Willcox Co., Inc., 1982.

Sams, Howard W. Basic Electricity/Electronics, Book I. Indianapolis: The Bob-Merrill Company, Inc., 1978.

Sams, Howard W. Basic Electricity/Electronics, Book II. Indianapolis: The Bob-Merrill Company, Inc., 1978.

Schuler, Charles. Electronics - Principles & Applications. California: McGraw-Hill, 1979.

Curriculum Guides

Basic Electronics (First Year). Stillwater, Oklahoma: University of Oklahoma, Oklahoma State Department of Vocational and Technical Education Curriculum, 1981.

Digital Microprocessor Course. Washington, D.C.: Electronic Industries Association, 1985.

Electronics Training Programs. Washington, D.C.: The National Trade Association of Consumer Electronics Manufacturers, 1985.

Audio Visual

Films

"Transistor", Film Library, Nashville, Tennessee: South Central Bell (27 minutes), 1980

Films continued:

"Microworld", Film Library, Nashville, Tennessee: South Central Bell (15 minutes), 1981

Filmstrips

Basic Electricity & Electronics Explained—Direct Current, Garden City, New York: Bergwall Productions Inc., 1975

Basic Electricity & Electronics Explained—Alternating Current, Garden City, New York: Bergwall Production Inc., 1977

Bergwall's Electronics Filmstrip Series, (First and Second Year), Garden City, New York: Bergwall Production Inc.